Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Nurses' confidence in starting a new venture, startup or project in the context of nurse-led hackathons: Results of prehackathon survey

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ABSTRACT

Background: A hackathon framework has been successfully applied to solving health care challenges, including COVID-19, without much documented evidence of nurses' baseline or acquired confidence.

Purpose: To understand differences in baseline confidence levels in starting a new venture, startup or project in the context of nurse-led hackathons.

Method: A retrospective secondary analysis of a presurvey of hackathon participants from two NurseHack4Health (NH4H) events held in 2021.

Discussion: Male nurses and international nurses were more confident than the U.S.-based nurses. When comparing the 75% of participants who had not attended a hackathon previously to the 25% of participants who had, there was an increased confidence level among non-nurses and among participants with the previous hackathon, datathon, and ideation experience.

Conclusion: If hackathons can help nurses identify strengths, add new expertise and boost confidence, it may empower nurses to pursue their ideas more effectively, aid professional growth, and provide affirmation of innovator self-identity.

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Introduction

In November 2019, the Society of Nurse Scientists, Innovators, Entrepreneurs, and Leaders (SONSIEL) set out to establish the first international nurse-led hackathon in response to an overwhelming need for nurses to be recognized as innovators (Sciasci, 2021) and be supported to advance the nursing profession and, ultimately, care delivery. SONSIEL quickly joined forces with Johnson & Johnson (J&J) for the in-person event held in New Brunswick, New Jersey. The 56-hrs Nurse Hackathon (Table 1) and its subsequent successes paved the way for future nurse hackathons. Further, this seminal work generated wider excitement and support from global participants and sponsors, including Microsoft and J&J.

Due to the pandemic, SONSIEL and J&J quickly pivoted and sought out partners that could help leverage the highly desired and needed hackathon to address issues and challenges affecting the nursing and health care workforce due to the COVID-19 outbreak. Presented during the International Year of the Nurse and Midwife and U.S.-based National Nurses Month in May 2020, SONSIEL, J&J, Microsoft, and dev up company launched the first NurseHack4Health (NH4H): COVID-19 Virtual Hackathon. Nurses, health care workers and experts from diverse backgrounds gathered virtually to develop solutions that could quickly address health care needs while the pandemic lingered.

With many positive reviews and social media coverage from individuals who attended the NH4H events (Johnson & Johnson Nursing, 2020; Kathiari, 2021), SONSIEL implemented a survey to learn more about participants, their experiences, and ongoing needs in a more efficient manner. The initial survey was disseminated prior to the launch of the May 2021 NH4H. After hearing anecdotal stories of self-discovery, self-validation, realization of participants' potential for achievement of their goals (FifthWindow.com, 2022; Johnson & Johnson, 2020; Outcomes Rocket, 2022a,b,c) and gaining access to survey data from two NH4H events, we sought to conduct a more in-depth analysis of the impact of NH4H events on nurses and non-nurse participants.

Background

Hackathons, Datathons and Ideation Events

Hackathons are intense short events at which teams develop rapid solutions to an existing problem centered around a particular topic such as COVID-19, an application type such as a game design, a community network such as coders working on open-source software, or a group such as nurses or students (https://www.hackingmedicine.mit.edu/.; Sciasci, 2021). The NurseHack4Health is an example of a nurse-led weekend-long hackathon that focuses on improving health care while introducing and supporting nurses' innovation skills (NurseHack4HealthTM, n.d.). The multidisciplinary teams including designers, health care professionals, software developers, and others work together to develop a solution to a specific problem within the event theme. Datathons are the types of "hack" events wherein participants focus on existing datasets to recognize patterns and develop solutions. One example is the Massachusetts Institute of Technology (MIT) Critical Care datathon to give data-scientists an opportunity to explore their interests (Aboab et al., 2016). Other terms frequently used are *innovation* or *design* sprints (Knapp et al., 2016) which take place over a period of five days. Upon completion of these events, participants create minimally viable products (MVPs) which some teams pursue post events and succeed as entrepreneurs.

Hackathon Framework

The hackathon framework has been utilized in computer sciences since the late 1990s consequently adopted by the Massachusetts Institute of Technology Hacking Medicine in 2011, and by nurses in 2019 (Kagan et al., 2021). Bye et al. (2018) described the use

Table 1 – List of all NurseHack4Health (NH4H) Events, Dates, and Partners

Event Name	Dates	Number of Participants	Partners
SONSIEL in-person Nurse Hackathon	November 15–17, 2019	–	SONSIEL and Johnson & Johnson
NurseHack4Health: COVID-19 Virtual Hackathon	May 15–17, 2020	489 attended (not part of the analysis)	SONSIEL, Johnson & Johnson, Microsoft, and dev up
NurseHack4Health: Pandemic Management – Improving Education and Communication	November 13–15, 2020	563 attended (not part of the analysis)	SONSIEL, Johnson & Johnson, Microsoft, and dev up
NurseHack4Health: Improving Access to Care	May 14–16, 2021	681 attended 371 (54%) responded to survey (294 were included in analysis)	SONSIEL, Johnson & Johnson, Microsoft, and dev up
NurseHack4Health: Building a Sustainable Workforce of the Future	November 5–7, 2021	488 attended 121 (25%) responded to survey (102 were included in analysis)	SONSIEL, Johnson & Johnson, and Microsoft

of hackathon framework in Europe as a tool for education in the latest knowledge and technology with involvement of various stakeholders to develop holistic solutions to real-life problems in geosciences. Engineers and other professionals in countries like Uganda, Greece, Colombia, and Mexico have been offering hackathons since 2015 to address mobile health (mHealth) in their respective countries, but noted a small number of health care providers, primarily physicians, attending some of them (Angelidis et al., 2016). Additionally, some hackathons served as means of enhancing collaborative science and building bridges over the traditional divide between multiple research investigators and institutions in the science arena (Ghouila et al., 2018; Groen and Calderhead, 2015). Hackathons have also been successfully conducted among high school students to provide them with authentic learning experience and empower and equip them with transferable skills for the real-world setting (Lyndon et al., 2018). A hackathon framework has been successfully applied to solving many health care challenges such as teamwork in critical care settings (McLeod et al., 2021); surgical workforce development (Ruzgar et al., 2020), user-driven self-care (Day et al. 2017) and rehabilitation medicine cases (Silver et al., 2016). As a result of its success, hackathon farmwork has been gaining popularity within the nursing profession.

Confidence

Based on the existing definition of confidence within the nursing literature, confidence is defined as "Self-confidence is a person's belief that he or she can succeed. Self-confidence is context-specific to particular tasks and some people seem to display this characteristic through a wide range of activities" (Perry, 2011, p. 219). Aside from this seminal work, there has been limited discussion of confidence in the context of entrepreneurship among nurses. Confidence as an entrepreneurial characteristic is not new to health care professionals, but it has not been robustly studied among nurses in the context of hackathons. While there are some studies examining confidence of nurses in clinical practice, studies on their confidence with new ventures, start-ups and projects are limited.

Confidence as an Entrepreneurial Characteristic

Confidence is one of several key characteristics among entrepreneurs and innovators. There has been an increase in published research on entrepreneurship among nurses in several countries. For example, oncology nurses at an Iran-based Shahid Sadoughi hospital demonstrated a high level of achievement motivation, and high level of tolerance for ambiguity, risk taking attitudes, and innovation, supporting significant positive relationships between psychological traits and entrepreneurial orientations, measured by a combinations of survey tools such as the scale of intolerance for ambiguity, Rotter's locus of control, Steers and Braunstein achievement items and the Jackson personality inventory (Dehghanzadeh et al., 2016). A study from Istanbul, Turkey, used Career Adapt-Abilities Scale, Ten Item Personality Inventory, and Scale of University Students Entrepreneurship and found that students with high entrepreneurial and intrapreneurial traits have better career adaptability, suggesting nursing education cultivate these traits to ensure their adaptation to the nursing profession (İspir et al., 2019). A cross-sectional study of undergraduate students from two institutions of higher education in Brazil also demonstrated high level of entrepreneurship characteristics in the profile of nursing students based on data collected using the validated Entrepreneurial Profile Assessment Tool and personal characteristics questionnaire (Jofre et al., 2021). According to Copelli's et al., (2019) integrative review of national and international literature on the concept of entrepreneurship in nursing showed that this concept is related to several personal and professional characteristics, including but not limited to self-confidence, innovation, autonomy, independence, and responsibility. Out of 31 articles, only 16% were published in the USA and used qualitative designs. National publications included Brazil, the United Kingdom, Australia, Canada, Iran, Finland, South Africa, and Sweden. Although confidence has been recognized as one of the entrepreneurial characteristics, it has not been examined in the context of hackathons. Nurse-led hackathons aim to build entrepreneurial skills and increase confidence by providing space, resources and support to participants who are interested in improving health care delivery and health outcomes through impactful, scalable, and accessible nurse-led and founded solutions.

Confidence in the Context of Hackathons

Many international nursing studies have focused on topics of nurses' burnout (Sullivan et al., 2022); hospital safety climate (Gurková et al., 2020) and "trends in internationally educated nurses' (IEN) National Council Licensure Examination-Registered Nurses (NCLEX-RN) performance" (Montegrico, 2021, p. 22), but not on comparing or describing nurses' confidence in pursuing a venture or a business in the United States of America or abroad. There is some literature on confidence development among nurses, nursing students and other health care professionals, but it is limited to specific specialties and educational environments. For example, in the United Kingdom, researchers aimed to develop nurses' confidence in neonatal intensive care through structured education program (Beynon, 2022); others looked to increase nurses' confidence in supporting patients presenting with self-harm in the ED (Hill, 2022); and nurses' self-confidence with family presence during resuscitation through an educational intervention (Bush & Woodley, 2022). A global analysis of 62 papers to determine facilitators and barriers to

competence and confidence development among nurses, midwifes and medical doctors found a category of "learning environment" (Goshomi et al., 2021), consisting of internal environment (psychosocial characteristics) and external environment (the physical learning environment, teaching and assessment methods) which were driven by experiences with the learning and practice environment. It is in accordance with Perry's (2011) analysis of confidence which may vary depending upon the setting or situation, person's intrinsic and extrinsic loci of control, external environment, and individual perceptions of efficacy. In the context of nurse-led hackathons, confidence in starting a venture, startup or a project was assessed on a Likert scale ranging 1, indicating that they are not confident, and 10, indicating that they are very confident.

Purpose

The objective of this quantitative retrospective study was to examine differences in baseline confidence levels in starting a new venture, startup or project in the context of nurse-led hackathons between nursing participants based on demographic characteristics, and between nursing and non-nursing participants who were new to hackathons and those who had previously attended.

Methods

Design

This study was a secondary analysis of data collected by the SONSIEL from two NH4H events held in May and November of 2021. The survey consisted of 20 questions and was collected via Microsoft forms. These included demographic questions, including age, preferred pronouns, race/ethnicity, geographic location, level of education, and profession. The survey also included questions about primary areas of expertise, years of professional experience and in nursing practice, confidence in starting a new venture or startup, importance of various aspects of a hackathon, and prior participation in similar events. There was an open-ended qualitative question that solicited information about the hackathons' impact. The survey, requiring about 5-min of time was distributed during registration for each event and was open until the day each event commenced. One survey was administrated in Spring of 2021 with event taking place in May and second in the Fall of 2021 with event scheduled in November. All data were de-identified and checked for completeness of responses before analysis in Excel and the Statistical Package for Social Sciences (SPSS) software, version 27. This research was approved by the Institutional Review Board at Molloy University as exempt.

Survey/Tool

For this study the variables of interest were demographic characteristics, particularly age, geographic location, profession, and confidence. Responses were filtered to compare respondents from within or outside of the United States, nurses, and non-nurses (software developers and designers, allied health care professionals, physicians, psychologist, journalists, economists, and others), and those who previously participated to those who did not have prior experience with similar events. Additionally, questions focusing on how confident participants were in starting their own venture or startup using a 10-point Likert scale (LS), and a question that allowed for free text were included in the analysis.

Sample

The Fall survey resulted in 371 responses and the Spring survey in 121 responses, with total of 492. After coaches and panelist responses were removed from both datasets, 396 responses were analyzed, with 295 and 101 responses respectively. Further, a subgroup of 234 nurses and nursing students within the dataset were analyzed when comparing self-reported confidence among nurses and nursing students from the United States to those in other countries, prior experience with similar events and other demographic variables. Since nurse-led hackathon was a novel experience for most participants, nurses and nursing students were included in the analysis.

The analysis plan includes (a) description of total participants and nursing participants in both hackathons; and (b) comparisons of confidence within the nursing participants followed by comparisons between nursing and non-nursing participants.

Results

Results are based on aggregated datasets from hackathons held in Spring and Fall of 2021 (Table 2). Just one quarter of respondents 101 (25%) had previous experience with hackathons, datathons, or ideation events. The majority of respondents had a Baccalaureate degree or higher 337 (85%) and were predominately female 188 (64%). Nurses and nursing students made up 234 (59%) of all participants. Of those, 32 (14%) had less than 2 years of RN experience, 89 (38%) had up to 10 years of experience, and 113 (48%) of nurses had more than 10 years of experience. Further demographic characteristics of all participants and additional breakdown of nurses/ nursing students are detailed in Table 2.

Table 2 – Demographic Data

Demographic Characteristics		*n* (%)	
		All Participants	Nurses
Age	18–24	58 (15)	21 (9)
	25–34	98 (25)	61 (26)
	35–44	86 (22)	50 (21)
	45–54	70 (18)	45 (19)
	Over 55	72 (18)	51 (22)
	Prefer not to say	8 (2)	5 (2)
	Under 18	4 (1)	1 (1)
Gender/Pronouns	Gender binary male (he)	117 (29)	39 (17)
	Gender binary female (she)	268 (76)	189 (81)
	Gender neutral (they)	4 (1)	2 (1)
	Prefer not to answer	7 (2)	4 (2)
Race/Ethnicity	White	165 (42)	106 (45)
	Asian	80 (20)	41 (17)
	Black or African American	83 (21)	51 (22)
	Hispanic/Latinx	33 (8)	14 (6)
	Multiracial/ethnic	15 (4)	9 (4)
	Native Hawaiian or Other Pacific Islander	1 (1)	1 (1)
	Prefer not to answer	19 (5)	12 (5)
Location	Rural (small towns, isolated villages, and unincorporated land)	39 (10)	28 (12)
	Suburban (within 30 min of a major city)	159 (40)	95 (41)
	Suburban (within commuting distance of a major city)	23 (6)	13 (6)
	Urban (large metropolitan area)	175 (44)	98 (42)
Country	United States	291 (74)	176 (75)
	International	105 (26)	58 (25)
Level of Education	High school or less	31 (8)	
	Certificate/diploma program	15 (4)	
	Associate degree	13 (3)	
	Bachelor's degree (including non-nursing)	136 (34)	
	Master's degree (including non-nursing)	140 (35)	
	Research-based doctoral degree (e.g., PhD, ScD, etc.)	23 (6)	
	Applied doctoral degree (DNP, DrPH, PharmD, EdD, MD)	38 (10)	
Prior Participation	No	295 (75)	192 (82)
	Yes	101 (25)	42 (18)
Profession	Non-nurses	162 (41)	
	Nurses/nursing students/other	234 (59)	
	RN		185 (79)
	NP/APRN		26 (11)
	Students		22 (9)
	Other (LPN)		1 (1)
	Total	396 (100)	234 (100)

The population of participants included white 165 (42%), Black or African American 83 (21%), Asian 80 (20%), Hispanic/Latinx 33 (8%), and multiracial/ethnic 15 (4%) with multiple age groups and geographic locations represented, including from 49 states and internationally. (Figure 1).

Higher confidence in Starting a Venture, a Project or a Startup Among Male Nurses/Nursing Students Using "He" Pronouns

Self-reported confidence rating selections among subgroups of nurses of various demographic characteristics, such as gender/pronoun use, age, location, racial/ethnic background, education, and nursing experience, were compared. For the purpose of this study, pronoun use in the survey was identified as gender binary male and female with "he" and "she" pronouns and gender neutral with "they" pronoun. The authors recognize the evolution of gender and gender identities, in addition to the use of what is commonly referred to as genderfluidity. ANOVA with Bonferroni multiple comparisons analysis yield statistically significant differences in self-reported confidence between nurses who identified as gender binary male, "he" pronoun, and nurses who identified as gender binary female, "she" pronoun ($M = 1.346$, $p < .008$), with no significant differences with other groups.

Higher confidence in Starting a Venture, a Project or a Startup Among Nurses/Nursing Students Outside the United States

To account for unequal sample size, a Welch's *t*-test for unequal variances was performed to compare self-reported confidence level in nurses/nursing students

Figure 1 – Represented countries from respondents in May and November NH4H events combined.

residing in the United States and internationally. There was a significant difference in self-reported confidence between nurses living in the Unites States (M = 6.04, SD = 2.478) and internationally (M = 7.19, SD = 1.905), $t(125) = 3.23$, $p < .001$. Those who resided internationally reported higher levels of confidence than those residing with the United States. A similar finding was also noted among all participants residing in the United States. (M = 6.23, SD = 2.455) compared to participants residing internationally (M = 7.38, SD = 1.888), $t(238) = 4.01$, $p < .001$, regardless of the profession.

Lower Confidence in Starting a Venture, a Project or a Startup Among Nurses/Nursing Students Than Other Students and Professionals

Confidence ratings selected by nurses/nursing students were compared to those selected by other participants. It was found that confidence ratings reported by nurses/nursing students (M = 6.32, SD = 2.398) were lower than those of other students and professionals (M = 6.85, SD = 2.305), $t(354) = 2.18$, $p < .030$ that participated in the study. There were no significant differences in confidence level between subgroups of nurses based on any other demographics, though previous participation resulted in higher confidence level among all participants who previously participated in either hackathons, datathons or ideation events (M = 7.13; SD = 1.809) compared to first time participants (M = 6.34, SD = 2.506), $t(239) = 3.42$, $p < .001$.

Desirable Hackathon Outcomes Remained Similar Among Nursing and Non-Nursing Professionals

To assess the hackathon outcomes that different individuals prioritized, participants were asked to rank hackathon outcomes in order of importance to them. Across all analyses, the outcome most commonly ranked first, particularly among nurses, were (a) "improve yourself & learn new skills (broadening of perspectives, living up to one's potential)," followed by (b) "practice innovation skills (create new product/service)," and (c) "collaborate with nurse participants." Other outcome choices varied between demographic groups (Table 3).

Impact of Hackathon on Personal Experience

Out of all 396 respondents from both events, 101 (26%) who previously participated in hackathons, datathons and ideation events included feedback on how hackathon experience changed them. Respondents were able to select more than one option, which included "It

Table 3 – Ranked Number One Desirable Hackathon Outcomes of Importance

Outcomes in order of Importance	Number of RN	Number of Others	Combined
1. Improve yourself and learn new skills	133	112	245
2. Practice innovation skills	45	29	74
3. Collaborate with nurse participants	17	7	24
4. Break down disciplinary boundaries	10	5	15
5. Network/meet new people	9	5	14
6. Develop your personal/professional brand	6	3	9
7. Personal satisfaction	6	2	8
8. Add value to your resume/CV	4	0	4
9. Fill a school/work requirement	1	1	2

did not impact me/I took no actions afterwards" 16 (11%); "Joined at least one innovation organization or Special Interest Group (SIG) for the first time" 46 (31%); "Pitched an idea outside of the hackathon" 29 (20%); "Joined an incubator or accelerator program" 13 (9%); "Taken steps towards creating a startup" 25 (17%); and additional comments were added under "Other" 17 (12%). The comments from "Other" were tallied in five categories. Written text included responses from participants with prior experience with hackathons, datathons and ideation events. Included are several examples of statements made, "help support other hacks," "continually increasing my knowledge in this area," "referred other nurse entrepreneurs to participate," "implemented ideas within a large corporation," "our ideas were taken by organizing body for them to develop," and "still polishing our idea."

Discussion

SONSIEL pioneered nurse-led hackathons that attracted nurses to attend in-person and also web-based NurseHack4Health events between 2019 and 2021. In 2021, SONSIEL began administering participant surveys for each event. Through collaboration with the organization, anonymized surveys from two events held in 2021 were analyzed to answer research questions centered around participants' self-reported confidence in starting their own venture, startup or project.

While demographic characteristics were similar among nurses and nursing students for both events, there were different distributions of overall participants between two events, including gender, race/ethnicity, country of origin, and the number of first-time participants. It is possible that an online format made these events more accessible to a more diverse groups of people nationally and internationally. Furthermore, both events were marketed over social media and by the sponsoring organizations, as well as experienced participants' referrals as stated by one of the respondents. Most importantly, the Year of the Nurse and Midwife was extended into 2021 with Nurses week and Florence Nightingale's birthday celebration taking place during the same month as the May hackathon event. Nurse-led hackathon may have been an attractive activity for more people who wished to celebrate nurses' contributions and innovation during the month of May, unlike in November, resulting in higher number in participants. Finally, the theme for the May event centered around *Access to Care* which may have of interest to nurses and non-nurses, while the November event focused on *Building a Sustainable Workforce of the Future*, which may have been of interest mostly to nurse leaders. These factors could have also contributed to the number of attendees.

Based on prior literature, only a small number of nurses, who are SONSIEL members, have previously participated in health-related hackathons or ideation events such as MIT (Koszalinski et al., 2021). While it was not specifically targeting nurses, during the COVID-19 pandemic, nurses' expertise was recognized as valuable and was being sought after by various industries looking to help solve health care crisis (Ayala et al., 2022; Braune et al., 2021). While others view nurses as content experts (Koszalinski et al., 2021) and most trusted professionals (Gallup Inc., 2020), nurses themselves may benefit from activities such as hackathons that help nurses recognize self-worth and build confidence. Since the COVID-19 pandemic, hackathons have become increasingly recognized as a valuable tool for removing barriers and allowing collaborative problem-solving, ideation, and innovation across disciplines. Actively seeking nurses' input can change the narrative of earlier years when significantly smaller number health care providers (Angelidis et al., 2016) participated in health care hackathons. Additionally, two other findings were of interest, including increased confidence level among male nurse participants, and among nurses living outside of the United States.

Although nurses and nursing students are not traditionally taught innovation, business and entrepreneurial skills, many often ideate solutions to daily work challenges. Despite representing one of the largest workforce segments in health care, nurses are credited with the least number of patents, documented discoveries, and the ability to view themselves as innovators (Davis & Glasgow, 2020). We deduced that nurses and nursing students did not view themselves as innovators and lacked a higher level of confidence conducive to the challenges and difficulties involved in business venture startup. The assumption that nurses and nursing students are not well educated for business project startups compared to other professionals is not clearly articulated in the literature, although there is growing interest in this area. Recently, Rogers' Diffusion of Innovation Theory (Dearing, 2009) was suggested as a reliable framework for innovative work in genomics and genetics in an integrated review (Puddester et al. 2022). Outcomes of the paper suggested that nurses who are confident in translation and adoption of innovation are affected by attitudes surrounding adoption of innovation, including relative advantage, compatibility, complexity, trialability, and observability. It is logical to assert that the appropriate framework could be used to move nurses forward in full confidence to innovate, noting that confidence is not novel, but the application of confidence to innovative spaces is novel. However, nurses are uniquely positioned to lead innovation, which was, at last, recognized by the American Association of Colleges of Nursing (2021). The National Academy of Medicine (2021) envisions inclusion of curricula to emphasize design and innovation thinking, team work beyond the typically siloed disciplines, and robust communication. Several colleges of nursing have answered the call to include innovation and entrepreneurship certificates in nursing (Guiliano et al.,

2022). This information is congruent with the outcomes of this secondary analysis.

The Future of Nursing 2020-2030 calls for innovation and bold ideas to transform nursing education (Welch & Smith, 2022). Domain eight specifically calls for information and communication technologies and informatics processes that provide care, gather data, and support informed evidence-based decision making (Welch & Smith, 2022). Nursing practice is equally dynamic through the concept of social entrepreneurship whereby nurses stretch their knowledge to better care for patients and act as change agents. Acting as change agents means seeking and seizing unseen opportunities, improving systems, inventing new approaches, and creating sustainable solutions (Altman & Brinker, 2016). This is congruent with what the research team learned, which is, nurses will participate in hackathon events and will bring crucial clinical knowledge to the table. Further, nurses are eager to participate in the development of sustainable solutions and pursue confidence in their abilities to contribute to an intra-professional team. Partners from other disciplines were equally enthusiastic about collaboration with nurses. Nurses are in a rare period of time when academic and practice silos are no longer preventing collaboration and forward thinking, bold ideas.

It was confirmed that non-nurses and students were more confident than nurses and nursing students. We assert many participated in the NH4H because they wanted to increase their confidence by improving and learning new skills, such as broadening of perspectives, and living up to ones' potential, as well as practicing innovation skills such as creating new products or services. These two items were the topmost commonly selected by participants. Furthermore, there was an indication that NH4H made an impact on personal experience of those who previously participated in similar events. In addition to the solutions participants generate, hackathons provide authentic learning experiences that foster mastery of the content, development of technical and thinking skills, and creation of supportive professional and social networks (Angelidis et al., 2016).

Implications

The COVID-19 pandemic demonstrated nurses' ability to be innovative not only at the bedside but also in the community, frequently without a formal structure, space, or guidance, which nurse-led hackathons can offer to nurses working across all settings and geographic locations. Hackathons also provide extracurricular learning opportunities for students and clinicians to work with interdisciplinary colleagues outside of the hospital setting. The hackathon is a framework to consider when thinking about unleashing creative capacity and building confidence beyond the usual structured and regulated environments within nursing education, practice, and research.

Future Recommendations

Research about nurses' confidence in pursuing a venture or a startup among nurses residing in the United States and abroad is lacking. Our pilot work was based on an assumption since we did not have a formal hypothesis. The next step could be the development of a clear definition of confidence in the context of entrepreneurship and hackathons. In light of the findings related to increased confidence among international nurses vs. nurses residing in the United States, future studies should explore factors associated with this disparity. Additionally, a longitudinal study to track the impact of hackathons on participants over time may provide additional information on how these events shape nurses' career trajectory, and value they bring to organization, such as return on investment for the system. Finally, due to the lack of post hackathon data, two additional constructs of self-validation and self-discovery could not be fully ascertained and should be further investigated in relation to self-confidence.

Limitations

With secondary data analysis the results are limited to data contained in the survey and may not be generalizable to other populations. The presented findings were limited to prehackathon survey data, with no ability to control any variables, subject recruitment and survey follow-up. Additionally, the survey was not designed for a study and was not tested for internal validity or reliability. This represents pilot work to better understand hackathons and their impact on intra-collaborative teams, and especially on nurses.

Conclusion

The nurse-led hackathon is a one-of-a-kind framework that has the potential to provide nurses with opportunities for confidence-building. If hackathons can help nurses identify their strengths, add new expertise and boost confidence, it may empower nurses to pursue their ideas more effectively, aid their professional growth, and provide affirmation of their innovator self-identity, which ultimately benefits patients and health care.

Data Availability Statement

This data is not publicly available. For more information, please contact PI.

Author Contributions

Olga Kagan: conceptualization, methodology, formal analysis, writing original draft, writing—review and editing, and project administration; Nico Gennaro Sciasci: conceptualization, resources, investigation, writing—original draft, writing—review and editing; Rebecca Koszalinski: conceptualization, methodology, writing—review and editing; Dana Kagan: methodology, formal analysis, writing—review, and editing; Marion Leary: conceptualization, writing—review, and editing; Hiyam Nadel: Conceptualization, writing—review, and editing.

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